Energy Concept Adviser

A new internet-based tool for
decision makers and their technical staff

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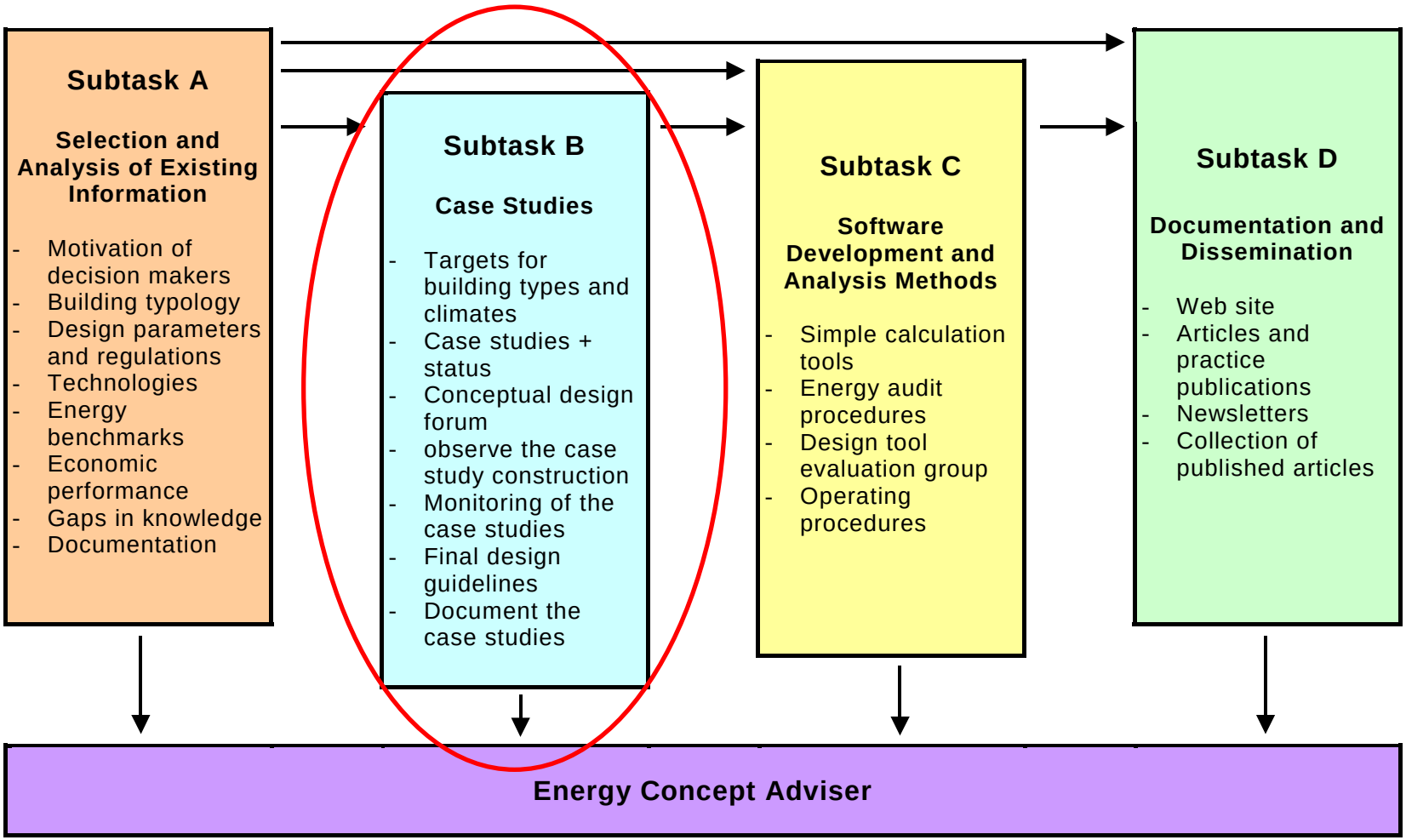
Structure of Annex 36



25 Case Studies from 10 Countries

View	country	case study
 	Germany	D1: Exemplary Retrofitting of a school in Stuttgart (EROS) D2: Bertolt-Brecht-School in Dresden D3: Paul-Robeson-School in Leipzig D4: University of Stuttgart D5: University of Ulm
	Denmark	DK1: Egebjerg School, Ballerup DK2: Enghøjskolen, Hvidovre DK3: Vridsløselille School, Albertslund
	Finland	SF1: Elementary School of Oulujoki SF2: Vihasitenkari Day Care Centre
	France	FR1: Louise Labe secondary school FR2: Gambetta professional high school

View	country	case study
	Greece	GR1: Chemical Engineering building NTUA, Athens GR2: University of Ionnina
	Norway	N1: Kampen School
	Poland	PL1: Secondary School Swarzedz PL2: Poznan University of Technology
 	UK	UK1: William Parker Com-munity Secondary School UK2: Hadley Junior School UK3: Grove House Refurbishment UK4: George Tomlinson School, Bolton, Lancashire UK5: Ketley Town Junior School
	USA	US1: Wausau West High School, Sullivan County, TN US2: University of New Hampshire

Energy Technologies by Case Study Overview

Energy technologies		Total
Building envelope	Windows	15
	Insulation materials & systems	13
	Over-cladding systems	1
	Doors	6
Heating systems	Heating installations	8
	Domestic hot water installations	5
	Energy sources	11
	Control systems	14
Ventilation systems	Natural ventilation systems	10
	Mechanical ventilation systems	8
	Hybrid ventilation systems	7
	Control & information systems	12

Energy Technologies by Case Study Overview

Energy technologies		Total
Solar control & cooling	Shading & glare protections	8
	Cooling systems	5
	Air-conditioning systems	3
	control systems	5
Light & electrical appliances	Lighting systems	11
	Electrical appliances	7
	Daylight technologies	8
	Control systems	10
Management	Energy audit techniques	6
	Commissioning	1
	Education & training	2
	Non-investment measures	2

Project aims

Project aims can be divided into 3 main groups:

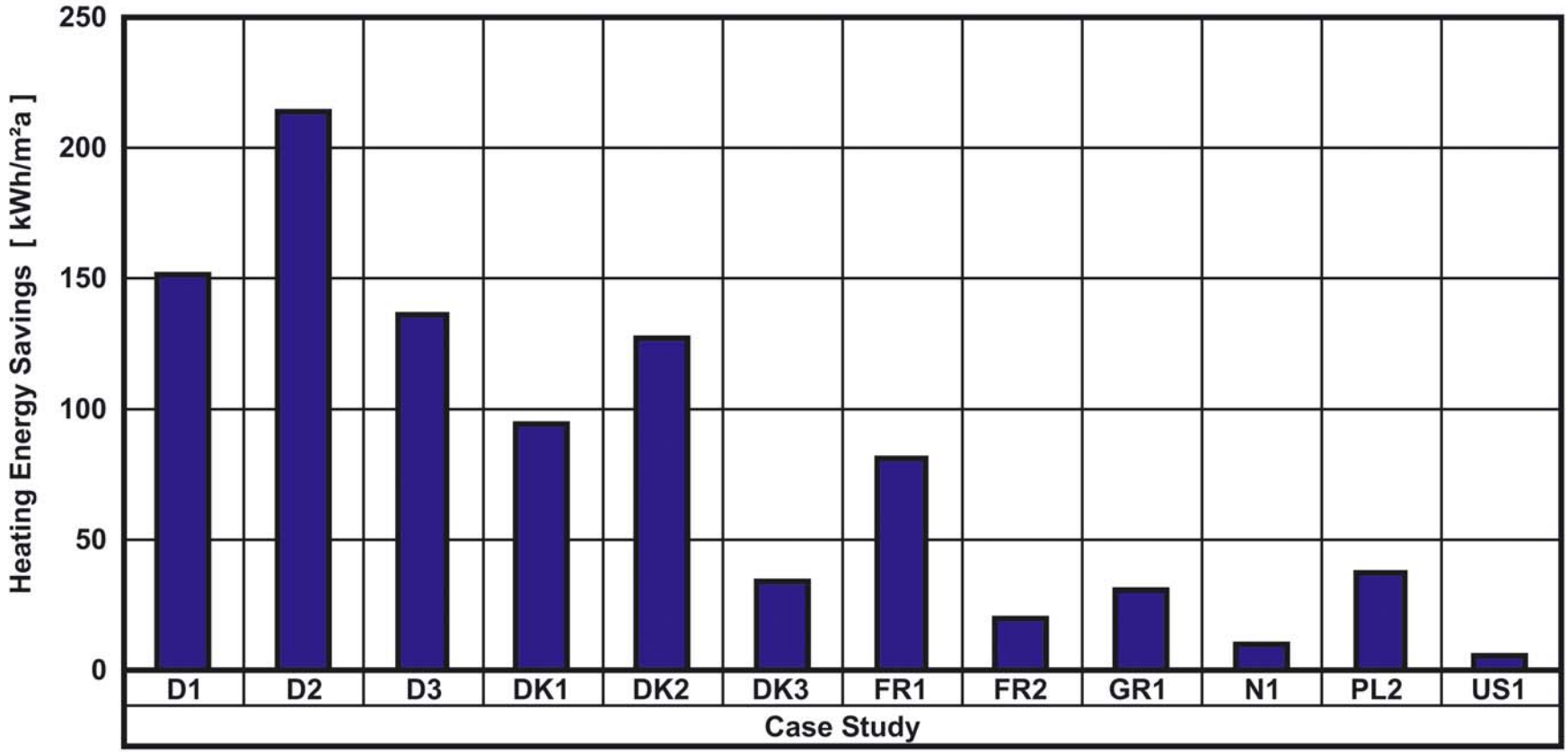
- holistic approach with several implemented energy saving technologies, high energy savings and less focus on short payback times
- cost-effective approach with fewer technologies and smaller savings
- focus on existing problems like indoor comfort, air-quality, lighting comfort. Energy savings as a positive side effect

Energy savings:

- as high as 75 % heating (German and Danish projects with 200-280 kWh/m²a before and 50-90 kWh/m²a after the retrofit) and 100 % electricity (Greek case study with PV-panels)
- UK and US projects with rather modest savings (8-20 % heating and 15 % electricity) but short paybacks

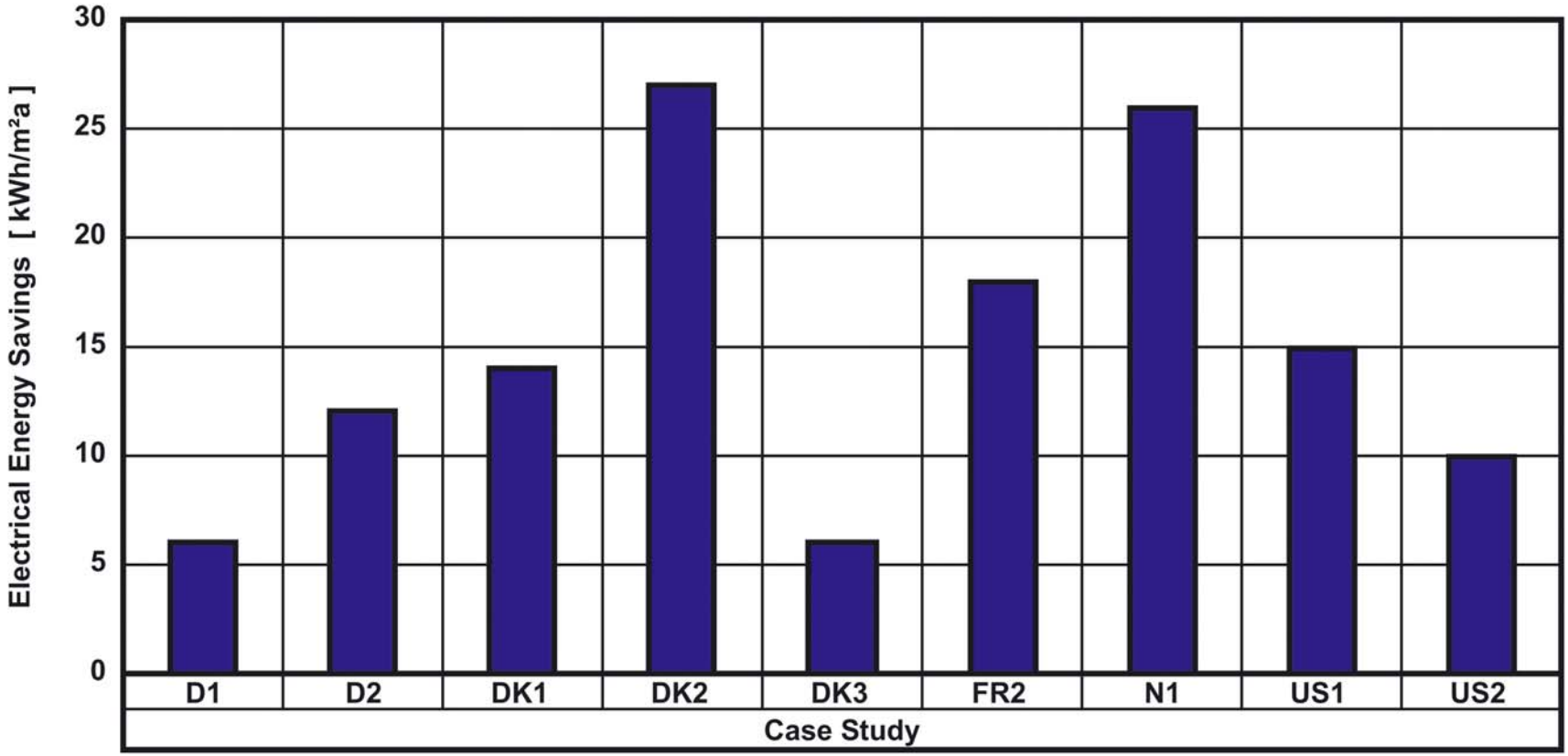
Energy Savings

Heating Energy Savings



Energy Savings

Electrical Energy Savings



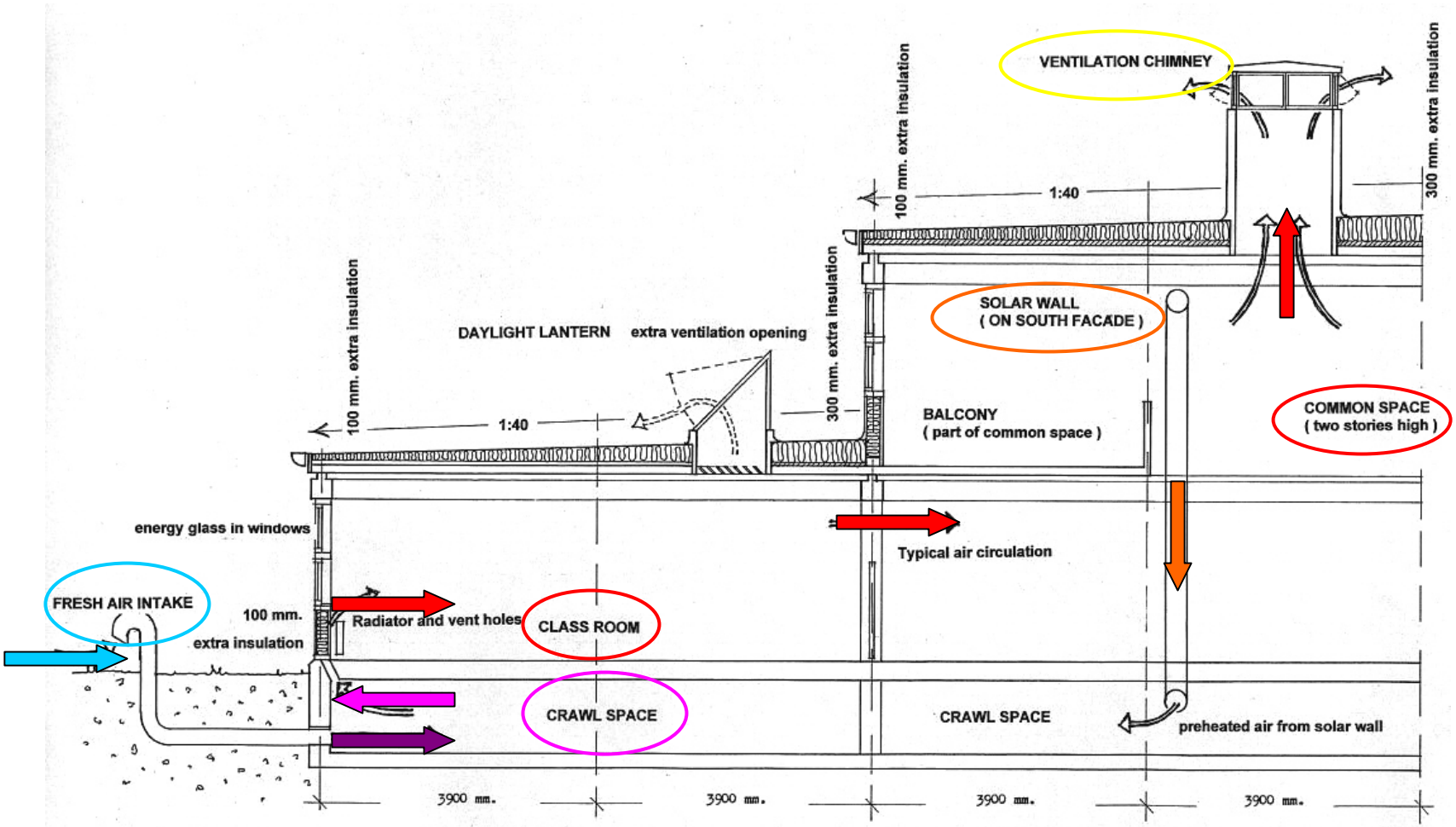
Ventilation Strategies

Different countries follow different ventilation strategies in the projects. Comparison of school projects:

	Finland	Focus on indoor air quality, mechanical ventilation with heat recovery
	Norway Denmark	Tendency to remove mechanical ventilation and replace it with natural hybrid ventilation, supported by fans if necessary
	Germany	- natural ventilation by opening the windows, can be supported by an indoor air quality visualisation - natural ventilation with pre-heating/pre-cooling by atria - natural ventilation through shafts into the classrooms and from there to corridors, supported by fans
	France	- minimum air-change rate provided by a mechanical ventilation system - natural ventilation by opening the windows
	Poland	Ventilation by opening the windows
	UK	Retrofit projects dealt not with ventilation strategies, but schools are mainly ventilated by opening the windows with sometimes mechanical ventilation by fans or draft support
	US	Ventilation through the windows, in one case additional mechanical ventilation system with heat recovery

Example: Egebjerg School, Ballerup, Denmark

Example: Egebjerg School, Ballerup, Denmark



Example: Egebjerg School – Air Intake

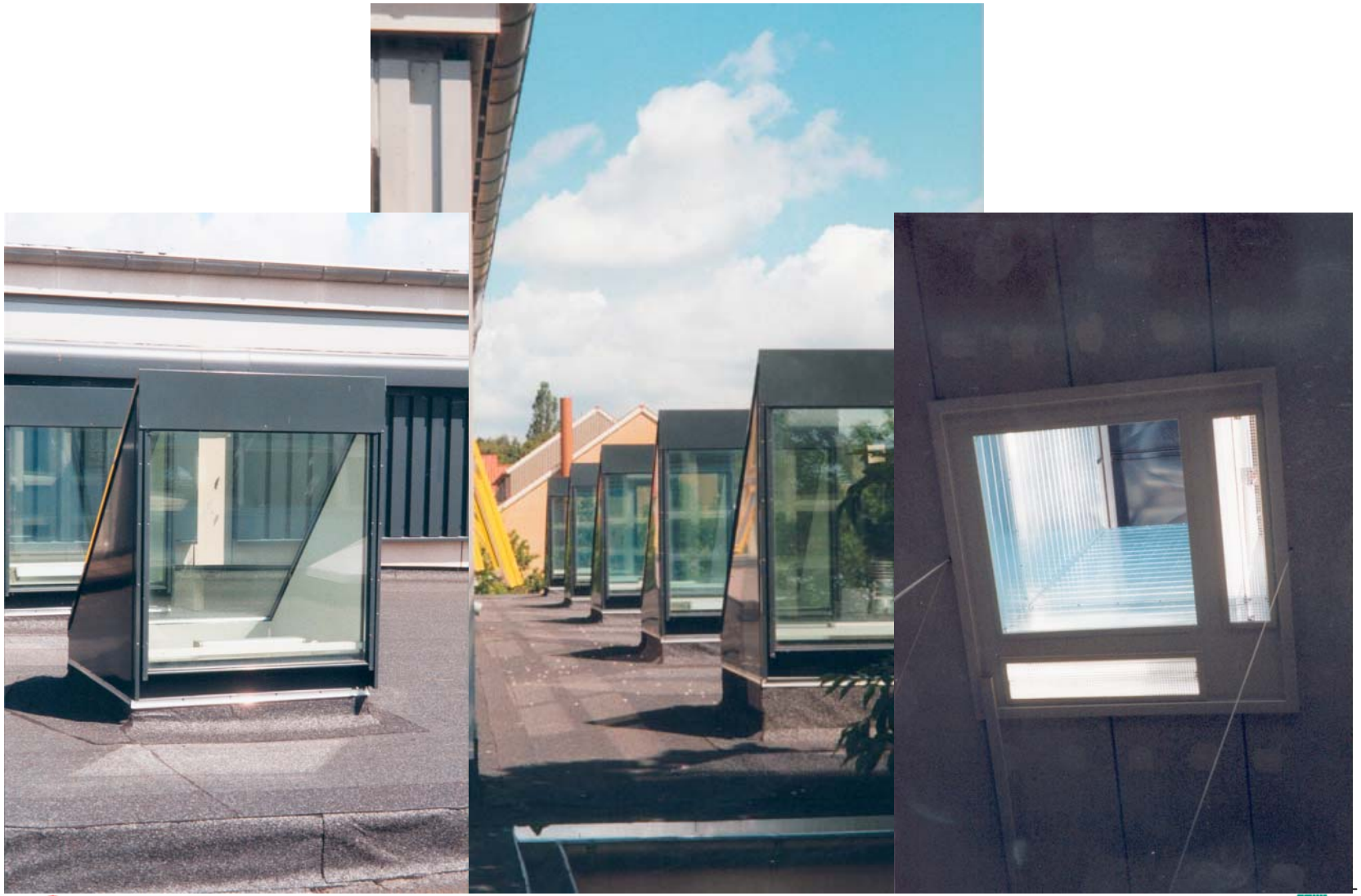
Example: Egebjerg School – Air Distribution in the Classrooms

Example: Egebjerg School – Common Space

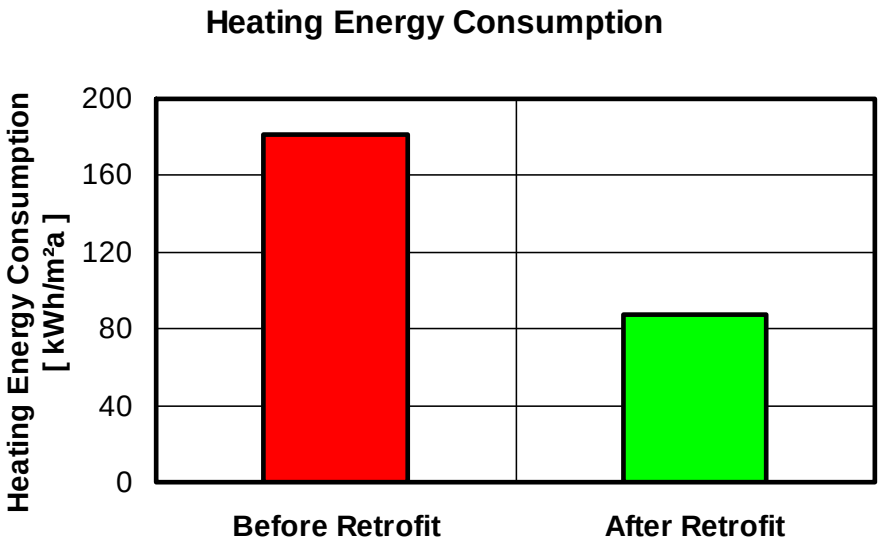
Example: Egebjerg School – Ventilation Chimney

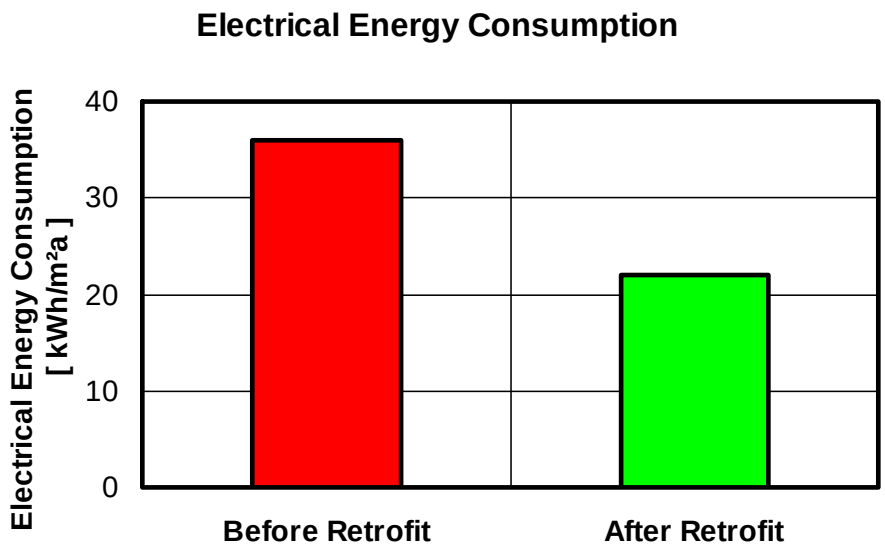
Example: Egebjerg School – Preheated Air by Solar Wall

Example: Egebjerg School – Daylight Lanterns

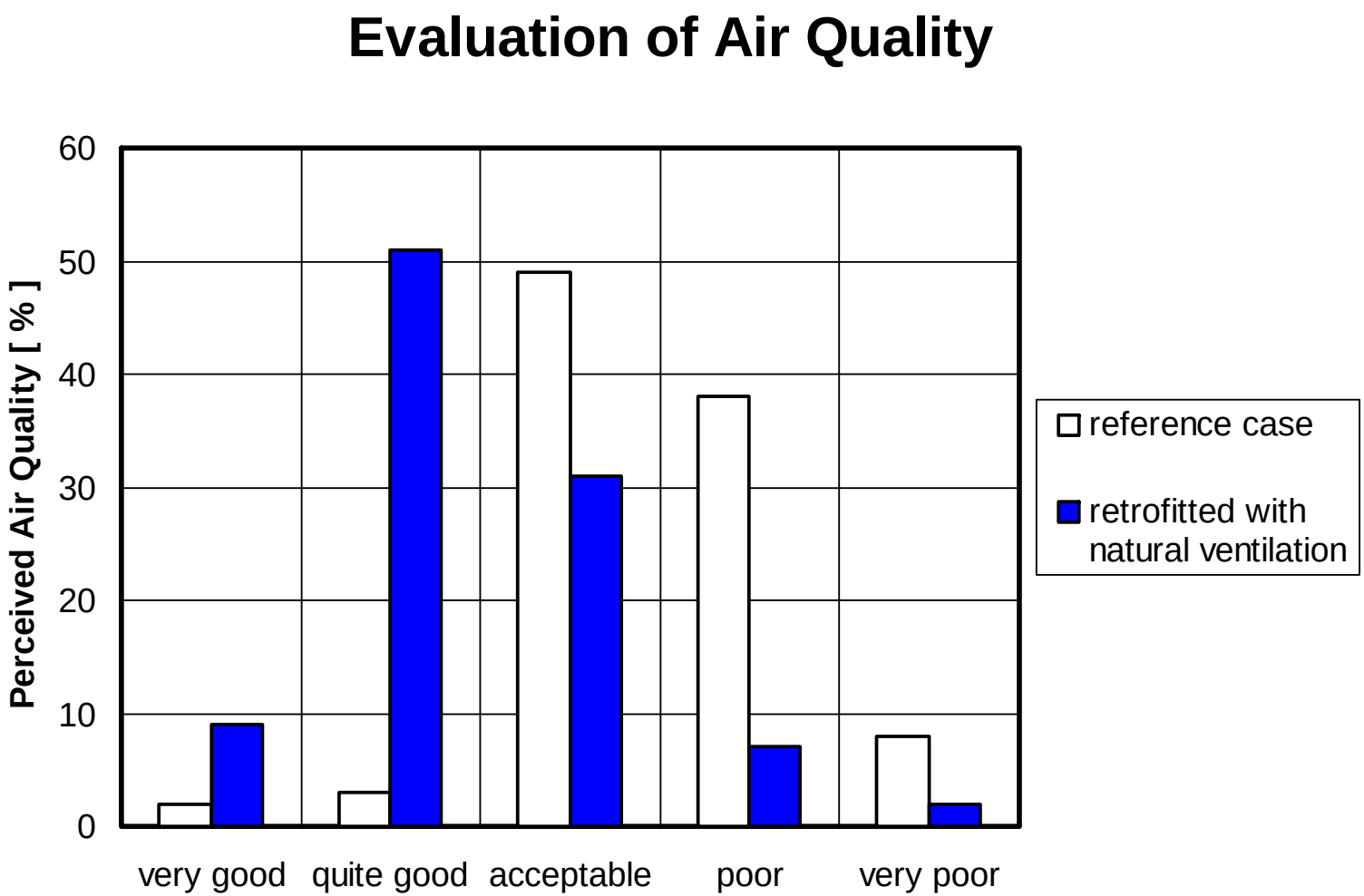


Example: Egebjerg School - Energy Savings



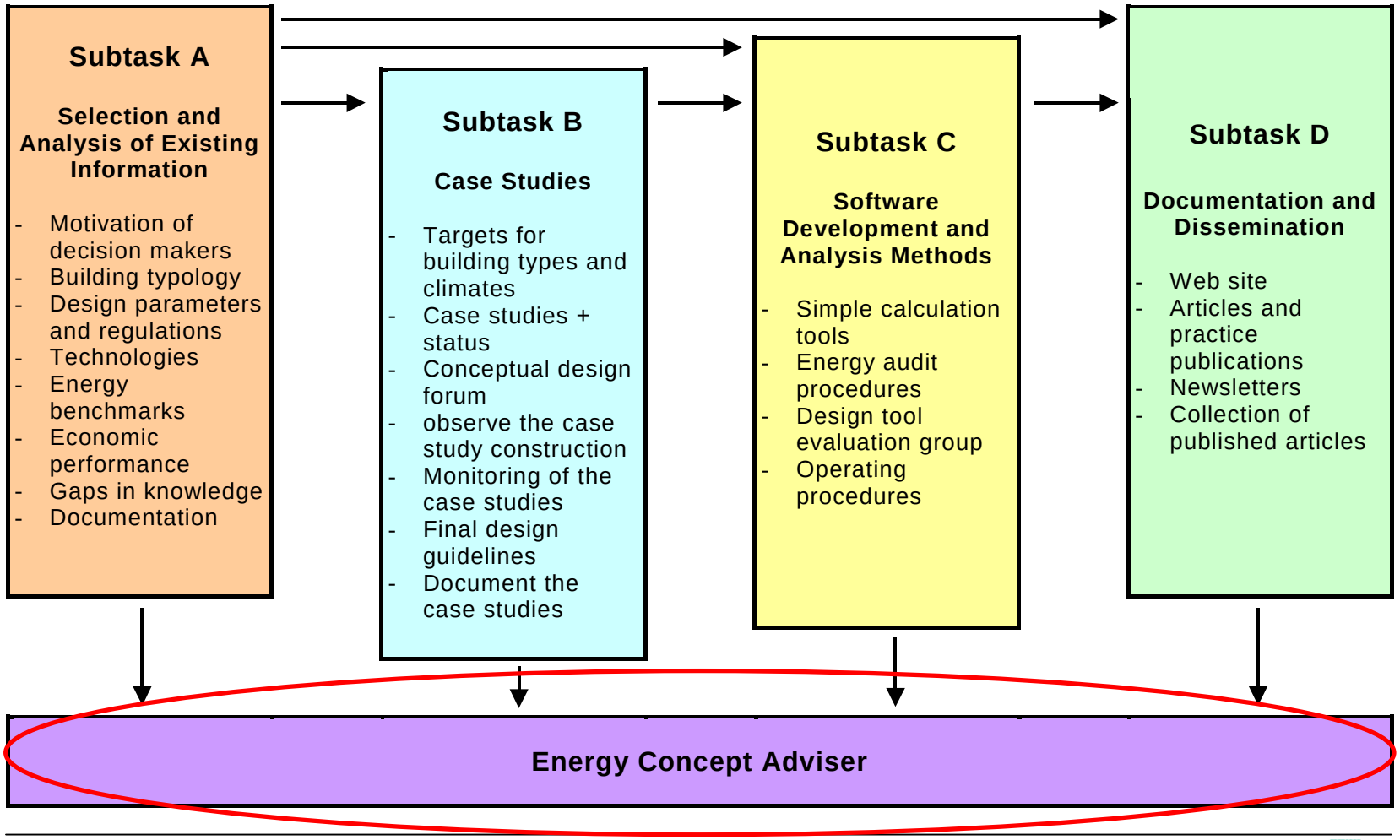


Example: Egebjerg School – User Evaluation



Example: Natural Ventilation – IAQ Visualisation

Structure of Annex 36



What are the reasons why the Energy Concept Adviser was developed?

- high energy consumption in educational buildings (nursery schools, schools, universities,…)
- decision makers are often not qualified enough informed
- many different factors for a high energy consumption
  building itself, heating system, ventilation, lighting, controls, (cooling)
- an estimation of investment costs and the potential of energy savings not possible without tools

ECA - Structure

Recommendations

Solutions for existing problems
e.g. IAQ, glare, high energy consumption

Case Study Viewer

Collection of exemplary retrofittings of educational buildings sorted by country and building type

Retrofit Measure Viewer

Collection and description of retrofit measures

Benchmarking

Comparison of the consumption of the own building with the typical average consumption of the country

Retrofit Concept Development

Starting with a building type you are able to analyze different retrofit measures on your own building. You can create different concepts and look on the energy relevant results as well as on the economic calculations

Auditing & Monitoring

Kulu and Auditing report

REDUCE
Retrofitting in Educational Buildings

INTERNATIONAL ENERGY AGENCY
Energy Conservation in Buildings & Community Systems Programme

ENERGY CONCEPT ADVISER
for Technical Retrofit Measures

country-specific-data:

REDUCE
Retrofitting in Educational Buildings

What is the Energy Concept Adviser?
The Energy Concept Adviser (ECA) is an electronic tool assisting in the design of renovations/retrofits focusing on energy savings of educational buildings (schools, university buildings and nursery schools). It will provide a potential list of solutions to specific energy related problems associated with the building shell, lighting or HVAC systems. The ECA contains more that 30 descriptions of exemplary retrofit/renovation projects and provides a wide and varied selection of retrofit technologies and strategies. The ECA will energy rate an existing educational building versus the national average for varied energy sources. Additionally, a calculation tool will provide energy savings and costs for retrofit technologies/strategies selected to be considered for improving the energy efficiency of the educational building.

Who is the target group of the Energy Concept Adviser?
The ECA was developed for educational building decision-makers and their staff, responsible for programming, planning and accomplishing the retrofit/renovation of existing facilities. With the use of the ECA, the energy saving potential within an existing building will be better understood during the development of a retrofit/renovation projects and therefore reduce the energy consumption of an existing building. The decision-makers will be provided with reliable information on conventional and innovative strategies and technologies and thereby gain improved planning reliability.

Who has developed the Energy Concept Adviser?
The Adviser was developed in the framework of the International Energy Agency (IEA) in the project Annex 36 of the Energy Conservation in Buildings and Community Systems division. Experts from 9 European countries and the USA brought in their national expertise, case studies and retrofit technologies to promote energy savings in the retrofit/renovation of existing buildings. See also Info & Contact .

How to operate the Energy Concept Adviser?
The user-interface is developed for intuitive use; the information paths shall be recognized intuitively. Additional information in the retrofit concept development part is provided under ! ; ? is for help functions. The main navigation bars are reached by clicking on the project logo on the upper left side of each page.

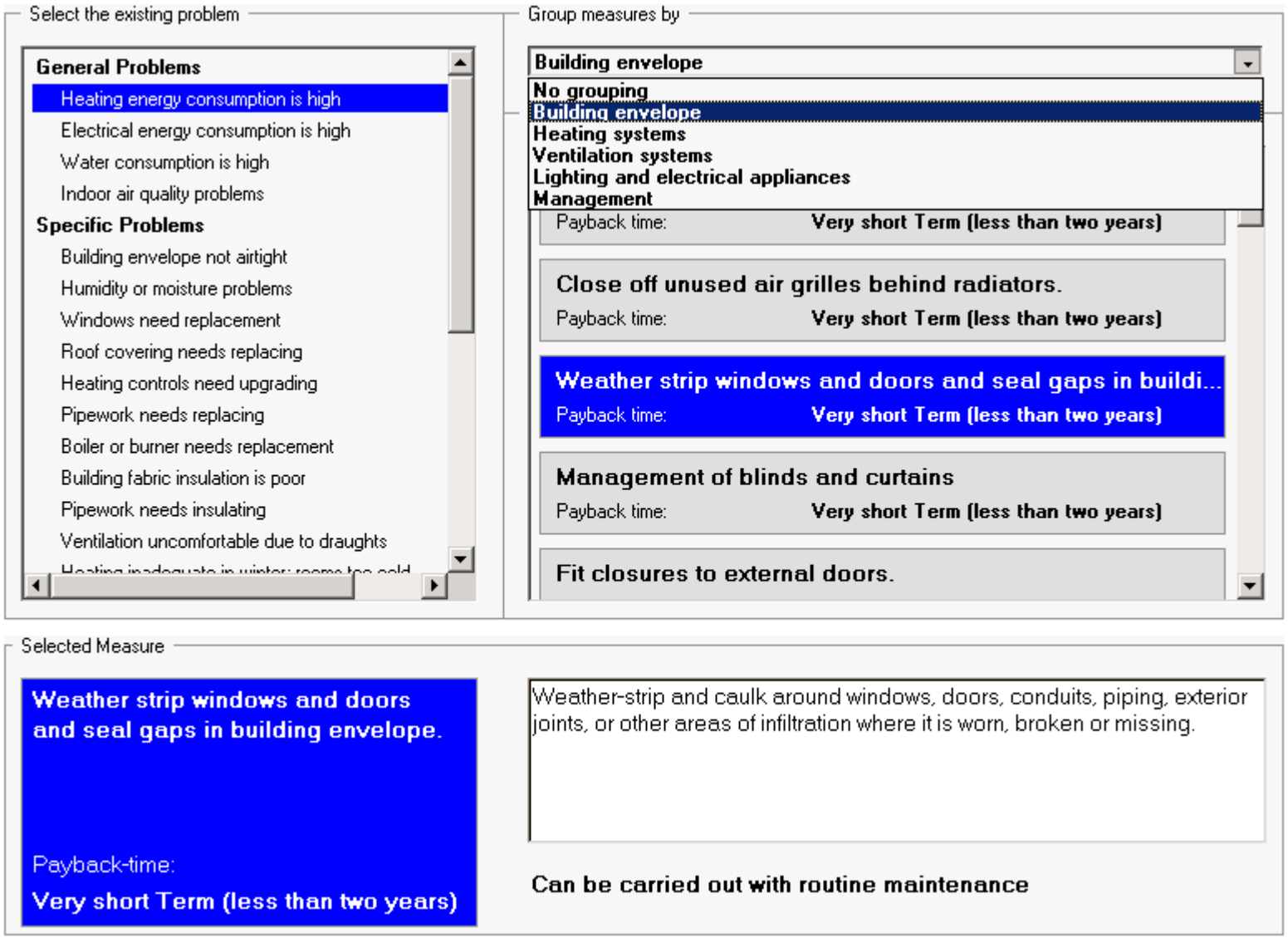
Start

REDUCE
Retrofitting in Educational Buildings

ENERGY CONCEPT ADVISER
for Technical Retrofit Measures

obtain recommendations for specific problems in your building	Recommendations
study more than 30 retrofitted buildings and retrofit measures	Case Studies & Retrofit Measures
compare your building's consumption to national data	Performance Rating
develop an energy efficient retrofit concept for your building	Retrofit Concept
programs and methods to analyse your building performance	Utilities
any questions	Info & Contact


Home
Problem Related Recommendation
General Information
This knowledge based list of recommended measures may fit only partly to your building.
Select your problem in the left column and in the right column it is possible to group the measures in main groups. Select the useful measures manually and read detailed description in the lower part.
Select the existing problem
General Problems
Heating energy consumption is high
Electrical energy consumption is high
Water consumption is high
Indoor air quality problems
Specific Problems
Building envelope not airtight
Humidity or moisture problems
Windows need replacement
Roof covering needs replacing
Heating controls need upgrading
Pipework needs replacing
Boiler or burner needs replacement
Building fabric insulation is poor
Pipework needs insulating
Ventilation uncomfortable due to draughts
Group measures by
No grouping
Possible measures
Close off open chimneys to prevent ventilation losses an...
Payback time: Very short Term (less than two years)
Close off unused air grilles behind radiators.
Payback time: Very short Term (less than two years)
Weather strip windows and doors and seal gaps in buildi...
Payback time: Very short Term (less than two years)
Install manual swimming pool cover.
Payback time: Very short Term (less than two years)
Replace existing gas or oil-fired boilers with condensing...


Select the existing problem
General Problems
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Boiler or burner needs replacement
Building fabric insulation is poor
Pipework needs insulating
Ventilation uncomfortable due to draughts
Group measures by
Building envelope
No grouping
Building envelope
Heating systems
Ventilation systems
Lighting and electrical appliances
Management
Payback time: Very short Term (less than two years)
Close off unused air grilles behind radiators.
Payback time: Very short Term (less than two years)
Weather strip windows and doors and seal gaps in buildi...
Payback time: Very short Term (less than two years)
Management of blinds and curtains
Payback time: Very short Term (less than two years)
Fit closures to external doors.
Selected Measure
Weather strip windows and doors and seal gaps in building envelope.
Payback-time:
Very short Term (less than two years)
Weather-strip and caulk around windows, doors, conduits, piping, exterior joints, or other areas of infiltration where it is worn, broken or missing.
Can be carried out with routine maintenance

Selected Measure

Install cooking sensor controls on the kitchen hood fans

Payback-time:
Very short Term (less than two years)

Kitchen extract fans extract large volumes of heated air and should only be on when required

Can be carried out with routine maintenance

Related Information

Retrofit Measure Viewer

Lighting and electrical appliances - Control systems

Case Study Viewer

Exemplary Retrofitting of a School (EROS) in Stuttgart, Germany

University of Stuttgart

University of Ulm

Home

Case Studies & Retrofit Measures

Sorting of:

Case Studies by country

Retrofit Measures by Energy technologies

Country	Case Studies \ Retrofit Measures						
		✓	✓			✓	
		✓	✓				
			✓	✓	✓		
		✓	✓			✓	✓
						✓	

Home

Case Studies & Retrofit Measures

Sorting of:

Case Studies by: age

Retrofit Measures by:

- country
- age
- typology

Country	Retrofit Measures / Case Studies	Building Envelope			
		Windows	Insulation materials & systems	Over-cladding systems	Doors
Pre 1930					
					
		✓	✓		✓
1930-1950					
		✓	✓		✓

Home

Case Study Viewer

Revnovation of Wausau West High School - Wausau, Wisconsin, United States

Download of REPORT as PDF

- General Data
- Site, Typology
- Before Retrofit
- Retrofit Concept
- Energy Savings
- User Evaluation
- Renovation Costs
- Lessons Learned
- Additional Information

General Data

Address of project	Wausau West High School, 1200 West Wausau Ave, Wausau, Wisconsin 54401, United States of America
Year of construction	1968
Year of renovation	1998-2001
Total floor area	25548 m^2
Number of pupils	1850
Numer of classrooms	65
Typical classroom	65 m^2 25 pupils

Wausau West High School

Project Summary

This school building HVAC System resulted in complaints regarding Indoor Air Quality and energy inefficiency. The Local Public Health Department had received complaints and had investigated. The complaints included hot and cold rooms, poor ventilation and poor IAQ. In addition, the lighting systems needed upgrading. The project objective was to improve the IAQ, comfort, and overall energy efficiency of the building.

Retrofit features

The heating system was converted from steam to hot water boilers. Three 9 million BTU boilers were replaced with seven 2 million BTU hot water boilers. The domestic hot water was changed from steam to direct fired natural gas. The dishwasher hot water booster was changed from electricity to gas. Ten pieces of kitchen equipment were changed from electricity to natural gas. Green house changed from propane to natural gas. Lighting was upgraded from T-12 fluorscents with magnetic ballasts to T-8 with electronic ballasts. The HVAC was upgraded using a new concept using existing technologies resulting in 100% outdoor fresh air being introduced into the classrooms.

Introduction
Shading & glare prot.
Cooling systems
Air-conditioning
Control systems

Shading systems and glare protections

To choose a solar control device we need to consider: the site latitude, the orientation of the facade, the orientation of the openings,the aesthetic of the facade, the glazing type of the window, the need for daylight, the solar control devices.
The overall thermal and optical performance of a solar control device in respect to solar radiation impinging on it is based on the phenomena: primary transmission, reflected transmission, diffuse transmission, solar absorption.
The global shading efficiency of a device is the result of all these direct and indirect transmission processes.

Shading systems and glare protections

Shading devices are also essential to avoid glare situations. If their luminous transmittance is too high, the risk of glare is significant. Several types of shading devices are sufficient to avoid glare from the sky: screens, reflective film, ionised film, sealed blinds.
Designers and decision makers must be conscious that the performance of the shading assembly might be different in the actual application conditions

Building Information

The building is a: educational building(general)

It has a heated floor area of: 5000,00

Reference climate zone: **mean climate**

Click here to get further Information about the climate zones

Consumption of electrical energy:

☐ **Includes heat energy consumption**

Unit of the consumption: kWh/m²a

Consumption: 56,00

Consumption of heat energy:

Energy source: oil

Unit of the consumption: kWh/m²a

Consumption: 233,00

Consumption of water:

Unit of the consumption: l/m²a

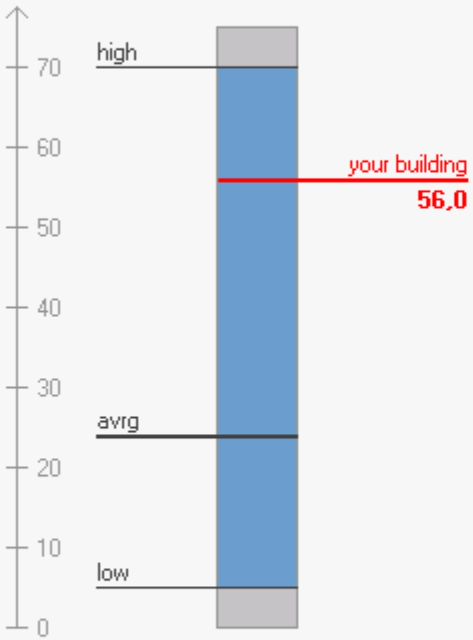
Consumption 174,00

Consumption of water:

Unit of the consumption: l/m²a **Consumption** 174,00

Attention! All energy consumptions are shown in kWh/m²a resp. water consumption in l/m²a.

Consumption of electrical energy [kWh/m²a]

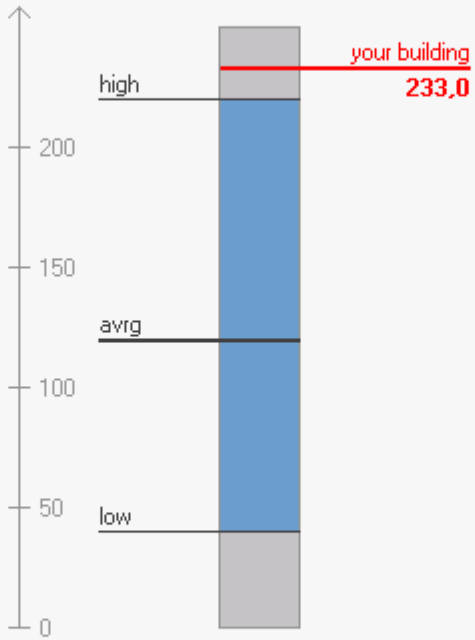


National survey:

Highest consumption:	**70,0**
Average consumption:	**24,0**
Lowest consumption:	**5,0**

Energy saving retrofit is recommended!

Consumption of oil [kWh/m²a]

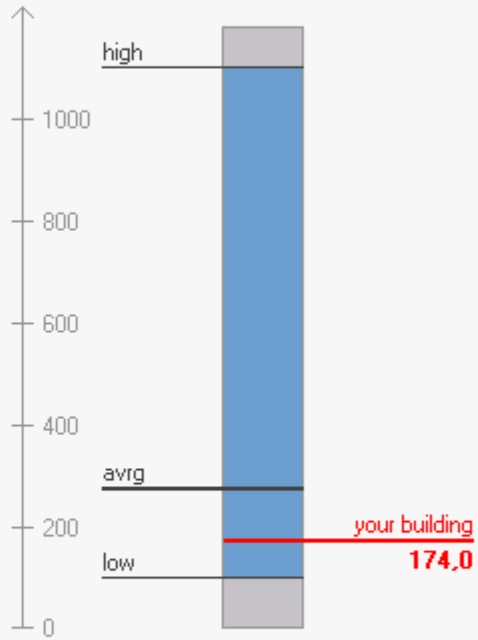


National survey:

Highest consumption:	**220,0**
Average consumption:	**120,0**
Lowest consumption:	**40,0**

Energy saving retrofit is highly recommended!

Consumption of water [l/m²a]



National survey:

Highest consumption:	**1100,0**
Average consumption:	**277,0**
Lowest consumption:	**100,0**

The water consumption is at a usual level!

Your consumption is compared to the results of a survey of Annex 36 about the energy consumption of educational buildings!

Retrofit Concept Development

General Information

The developement part is structured in the below listed sectors. A sector can be opened or closed by clicking on its bar. For all needed informations (values, costs, etc..) defined values from national studies are deposited, but could be changed individually by the user, so please check the deposited values for your confidence. If you need help, click on ?, for background information click on !.

- Describe the existing building ? +
- Select one retrofit measure for each building element ? +
- Create and compare energy saving concept ? +
- Summary and Report ? +

Describe the existing building

How to use this part

The building, for which the possibilities for a energy efficient should be analysed, is defined in this section.
By choosing the basic values, a default building is created.
This building can be further defined in the lower part of this section
If there was already a further definement, changes in the basic parts sets all the values back to default!

Define key values for a default building

Basic Data

Building Type: school

Construction year: pre 1950

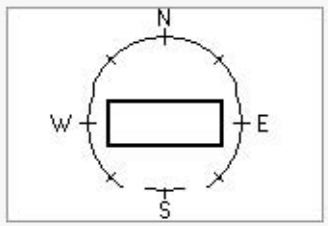
Type of Roof: pitched (heated attic)

Type of basement: slab on ground

Total floor area [m²]: 6180,00

Number of storeys: 3

Orientation:



Click on diagram to select orientation

Example buildings

Typology: multi-storey school

Click on picture to have a look at the case study!

Wausau West High School, Wisconsin
USA

Consumption of heat energy:

Energy source: Oil

Consumption: 374,00 kWh/m²a

Further Refinement of the building

Further Refinement of the building

Location

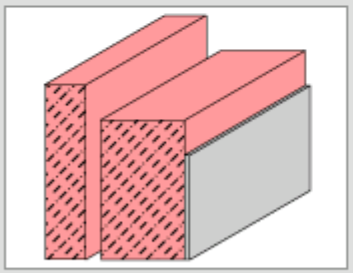
Geometry and Elements of Building Envelope

Heated volume:	33372,0	**Floor area:**	6180,0 m²
Ratio A/V:	0,32 1/m	**Area of thermal envelope:**	10815,0 m²

Switch through the different envelope elements:

|< | << | external wall | pitched roof | ground plate | window north | window east | >> | >|

external wall



Name: external wall

Area[m²]: 3955,20 **Maintenance Costs:** 4,00 €/m²a

Structure: double layered brickwork with 24 cm brick, 4 cm air, 11,5 cm brick and interior plast

Existing U-Value:

- 30 cm light brickwork with interior and exterior plaster
- 30 cm concrete stone with pumice brickwork with interior and exterior plaster
- 30 cm brickwork with interior and exterior plaster
- double layered brickwork with 24 cm brick, 4 cm air, 11,5 cm brick and interior plaster
- concrete sandwich construction: interrior plaster, 20 cm concrete, 4 cm insulation, 11,5
- 30 cm limestone brickwork, 4 cm insulation, interior and exterior plaster

☐ **Does this component have to be retrofitted anyway?** ○ in a minor refurbishment ○ in a major refurbishment

Heat and ventilation plant

Further Refinement of the building

Location

Geometry and Elements of Building Envelope

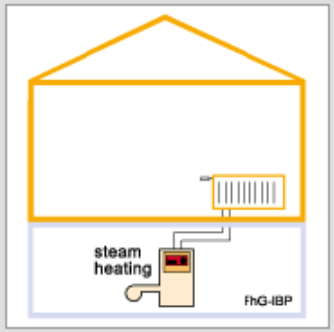
Heat and ventilation plant

Choose the existing plant

The heat energy is generated by: steam heating

The type of ventilation is: natural ventilation

Details of selected plant



Detailed description of the choosen plant:

steam boiler, steam heating, 105 °C, cast iron heating elements, no room regulations, natural ventilation

Adjusted setback modes: no setback

Used energy source Oil

☐ **Does this component have to be retrofitted anyway?** ◉ in a minor refurbishment ○ in a major refurbishment

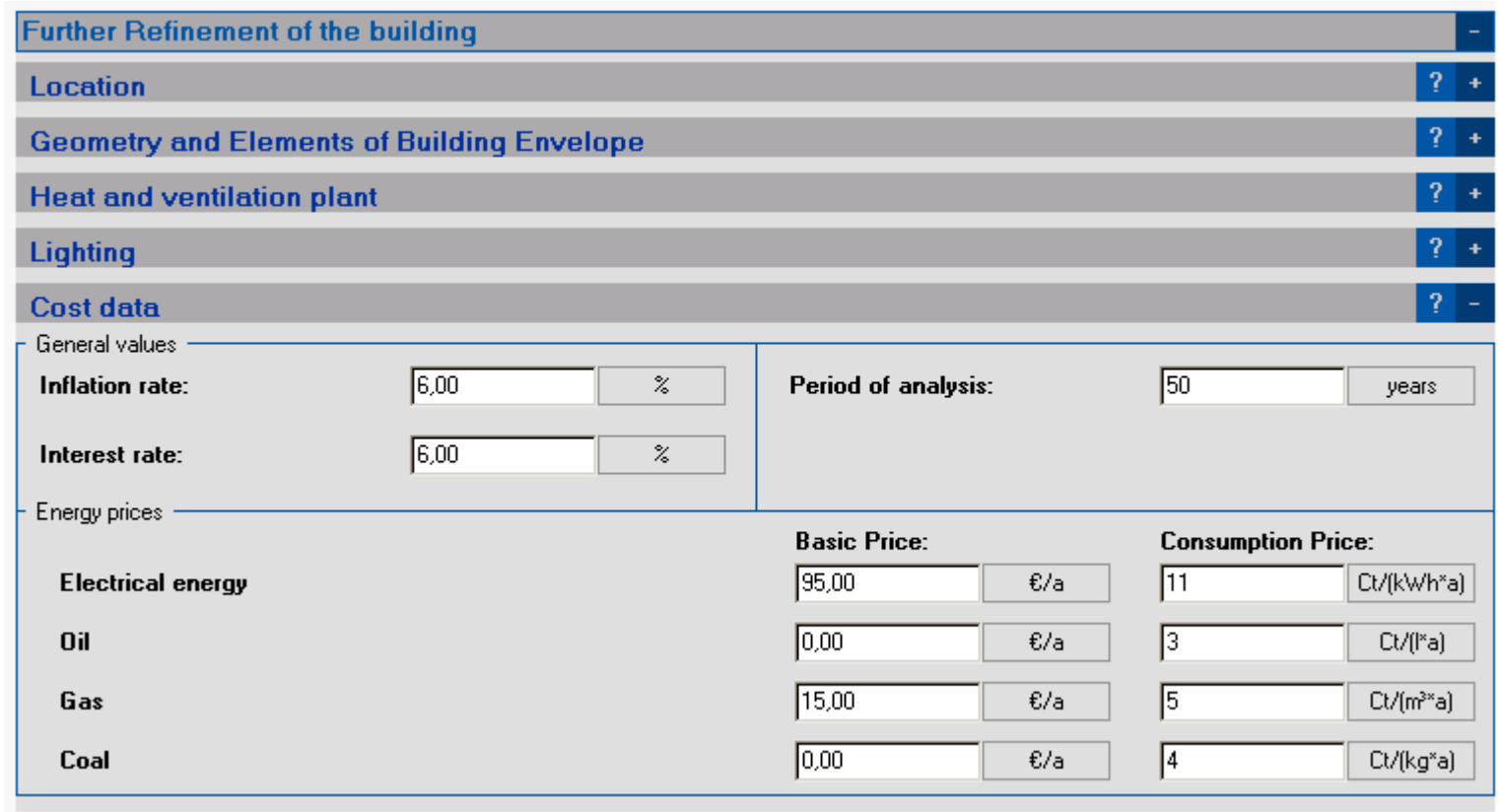
Lighting

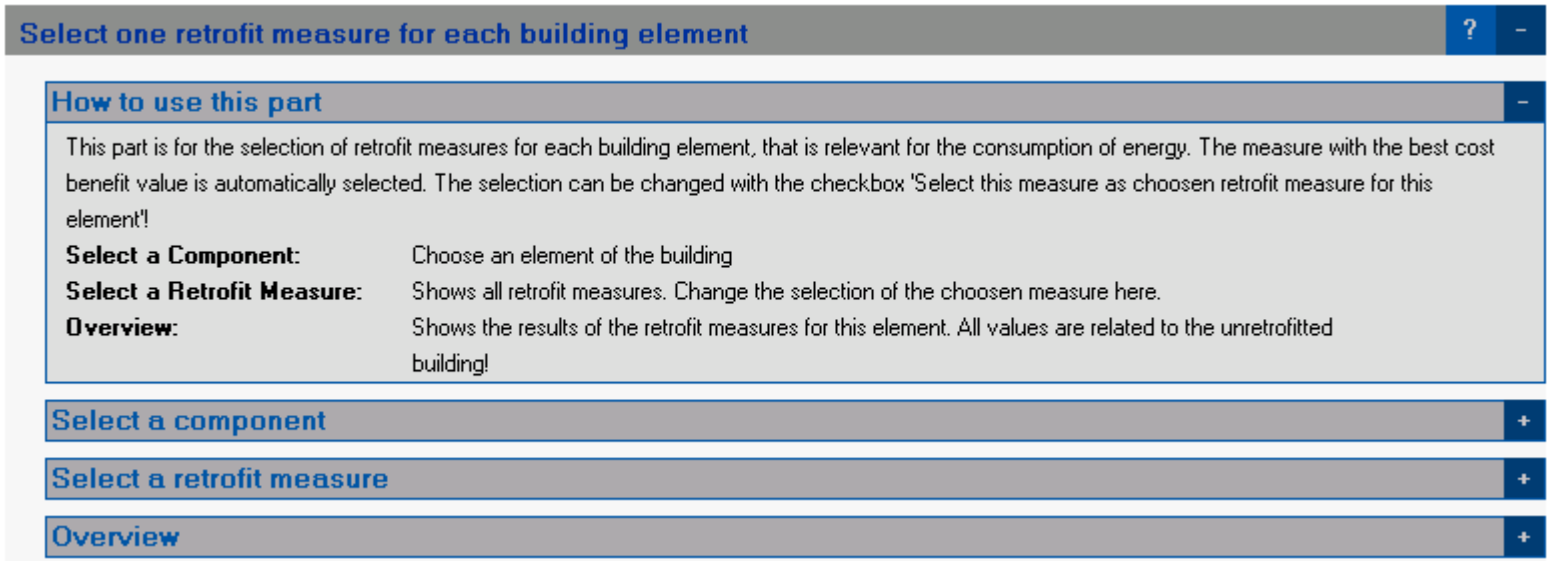
Classrooms

Fraction of total floor area:	75,0	%	**Installed System:**	Incandescent	
Fraction Area window/facade:	50,0	%	**Lighting control:**	Switch with manual control	
Mean room depth:	7,50	m	**Maintenance Costs:**	2,60	€/m²a

☐ **Does this component have to be retrofitted anyway?** ◉ in a minor refurbishment ○ in a major refurbishment

Cost data


Further Refinement of the building
Location
Geometry and Elements of Building Envelope
Heat and ventilation plant
Lighting
Cost data
General values
Inflation rate: 6,00 %
Interest rate: 6,00 %
Period of analysis: 50 years
Energy prices
Basic Price:
Consumption Price:
Electrical energy 95,00 €/a 11 Ct/(kWh*a)
Oil 0,00 €/a 3 Ct/(l*a)
Gas 15,00 €/a 5 Ct/(m³*a)
Coal 0,00 €/a 4 Ct/(kg*a)


Select one retrofit measure for each building element
?
-
How to use this part
-
This part is for the selection of retrofit measures for each building element, that is relevant for the consumption of energy. The measure with the best cost benefit value is automatically selected. The selection can be changed with the checkbox 'Select this measure as choosen retrofit measure for this element'!
Select a Component: Choose an element of the building
Select a Retrofit Measure: Shows all retrofit measures. Change the selection of the choosen measure here.
Overview: Shows the results of the retrofit measures for this element. All values are related to the unretrofitted building!
Select a component
+
Select a retrofit measure
+
Overview
+

Select one retrofit measure for each building element

How to use this part

Select a component

Main Group: Building envelope — **Element:** external wall

Existing Structure: double layered brickwork with 24 cm brick, 4 cm air, 11,5 cm brick and interior plaster

Existing U-Value: 1,47 W/m²K

Select a retrofit measure

1 internal insulation with 6 cm polystyrene, vapour barrier and gypsum board (mind thermal bridges, follow-up costs and sp

improved U-Value: 0,46 W/m²K — Investment costs: 50,00 €/m² — Maintenance costs: 4,00 €/m²a

(•) Select this measure as choosen retrofit measure for this element

2 external insulation with 12 cm mineral wool and plaster

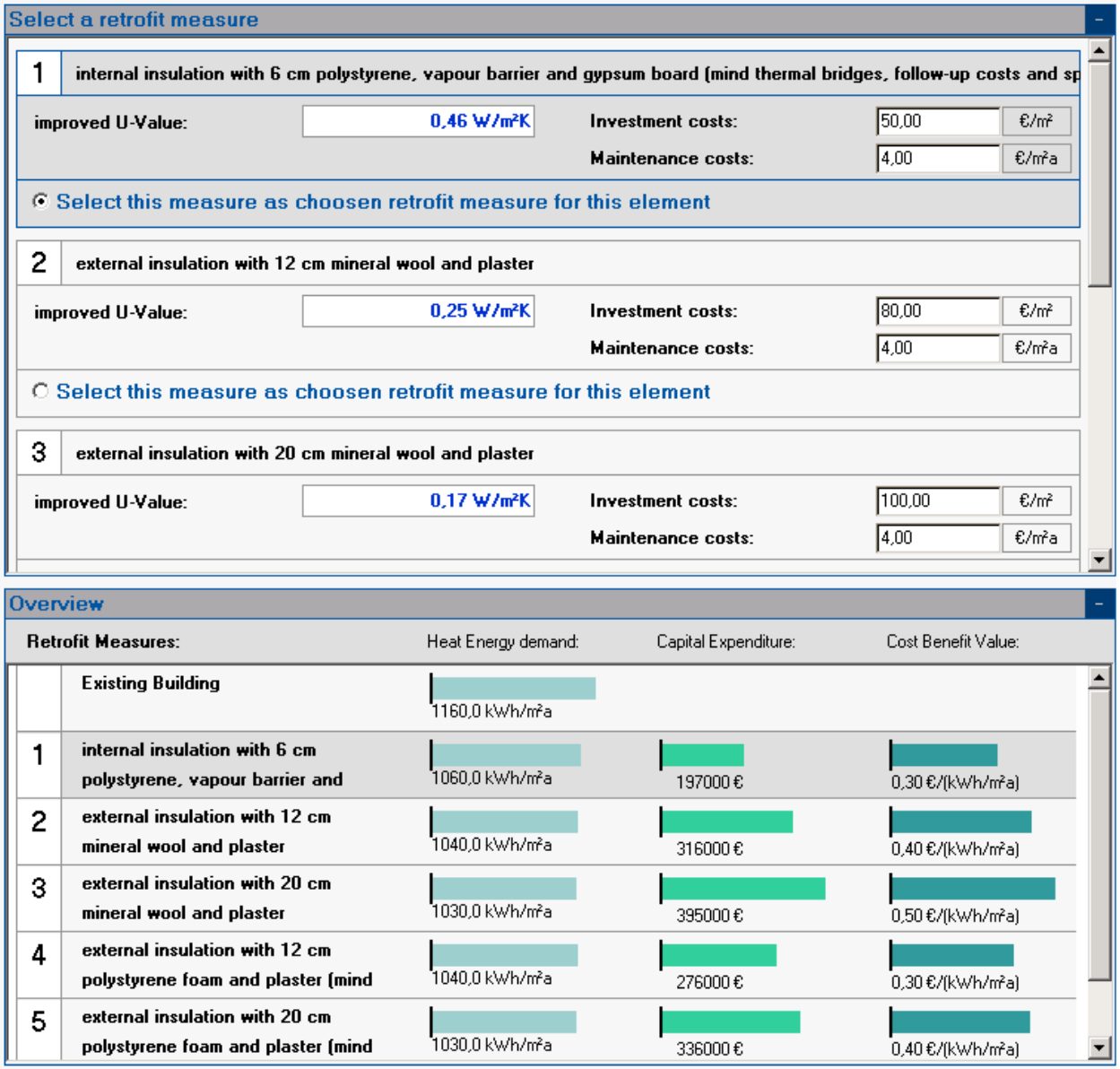
improved U-Value: 0,25 W/m²K — Investment costs: 80,00 €/m² — Maintenance costs: 4,00 €/m²a

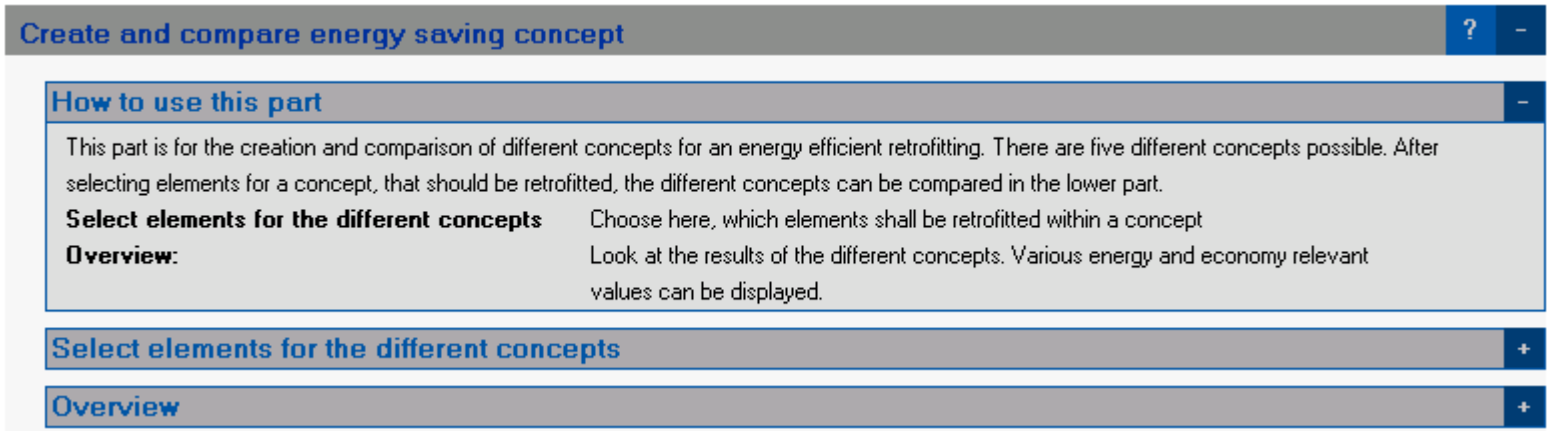
( ) Select this measure as choosen retrofit measure for this element

3 external insulation with 20 cm mineral wool and plaster

improved U-Value: 0,17 W/m²K — Investment costs: 100,00 €/m² — Maintenance costs: 4,00 €/m²a

Overview


Select a retrofit measure
1
internal insulation with 6 cm polystyrene, vapour barrier and gypsum board (mind thermal bridges, follow-up costs and sp
improved U-Value:
0,46 W/m²K
Investment costs:
50,00
€/m²
Maintenance costs:
4,00
€/m²a
Select this measure as choosen retrofit measure for this element
2
external insulation with 12 cm mineral wool and plaster
improved U-Value:
0,25 W/m²K
Investment costs:
80,00
€/m²
Maintenance costs:
4,00
€/m²a
Select this measure as choosen retrofit measure for this element
3
external insulation with 20 cm mineral wool and plaster
improved U-Value:
0,17 W/m²K
Investment costs:
100,00
€/m²
Maintenance costs:
4,00
€/m²a
Overview
Retrofit Measures:
Heat Energy demand:
Capital Expenditure:
Cost Benefit Value:
Existing Building
1160,0 kWh/m²a
1
internal insulation with 6 cm polystyrene, vapour barrier and
1060,0 kWh/m²a
197000 €
0,30 €/(kWh/m²a)
2
external insulation with 12 cm mineral wool and plaster
1040,0 kWh/m²a
316000 €
0,40 €/(kWh/m²a)
3
external insulation with 20 cm mineral wool and plaster
1030,0 kWh/m²a
395000 €
0,50 €/(kWh/m²a)
4
external insulation with 12 cm polystyrene foam and plaster (mind
1040,0 kWh/m²a
276000 €
0,30 €/(kWh/m²a)
5
external insulation with 20 cm polystyrene foam and plaster (mind
1030,0 kWh/m²a
336000 €
0,40 €/(kWh/m²a)


Create and compare energy saving concept
?
-
How to use this part
-
This part is for the creation and comparison of different concepts for an energy efficient retrofitting. There are five different concepts possible. After selecting elements for a concept, that should be retrofitted, the different concepts can be compared in the lower part.
Select elements for the different concepts
Choose here, which elements shall be retrofitted within a concept
Overview:
Look at the results of the different concepts. Various energy and economy relevant values can be displayed.
Select elements for the different concepts
+
Overview
+

Select elements for the different concepts

Element: / Choosen retrofit measure:	Concept 1	2	3	4	5
pitched roof 14 cm mineral wool insulation between the rafters, vapour barrier, water barrier, lattice	☑	☐	☐	☐	☐
ground plate 4 cm mineral wool, screedfloor (extra costs for shortening of the doors)	☐	☑	☐	☑	☑
steam heating Low Temperature Boiler 70/55	☐	☐	☐	☑	☐
external wall internal insulation with 6 cm polystyrene, vapour barrier and gypsum board (mind therr	☐	☐	☐	☑	☑
lighting source Compact Fluorescent	☐	☐	☐	☐	☐
window north					

The measures are sorted by benefit-cost-value

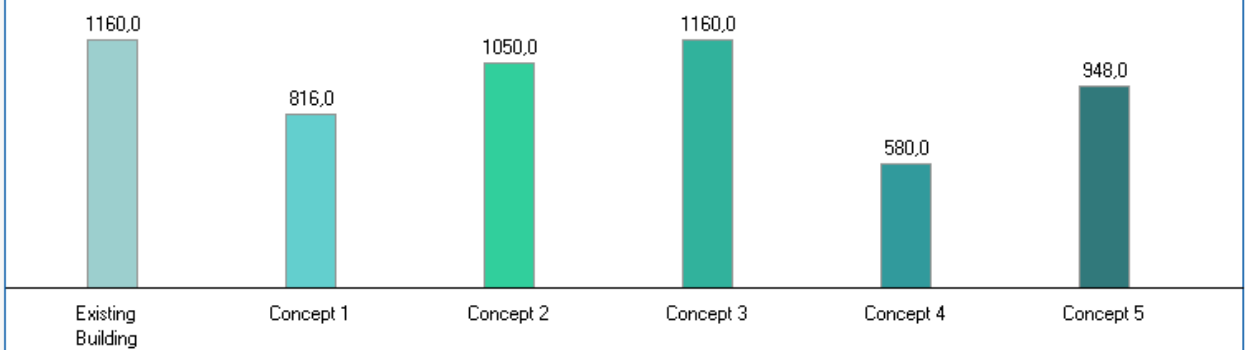
Overview

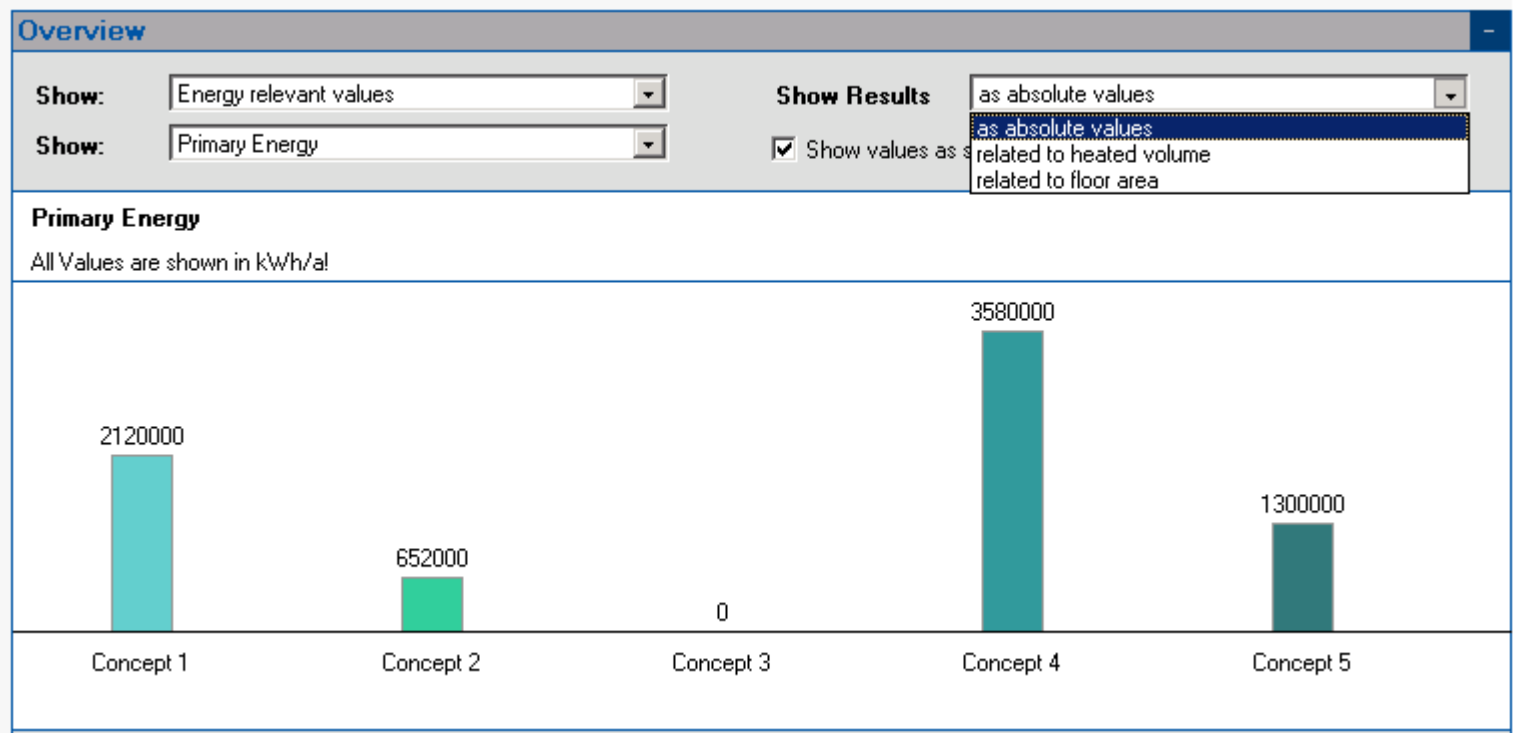
Show: Energy relevant values — **Show Results** related to floor area

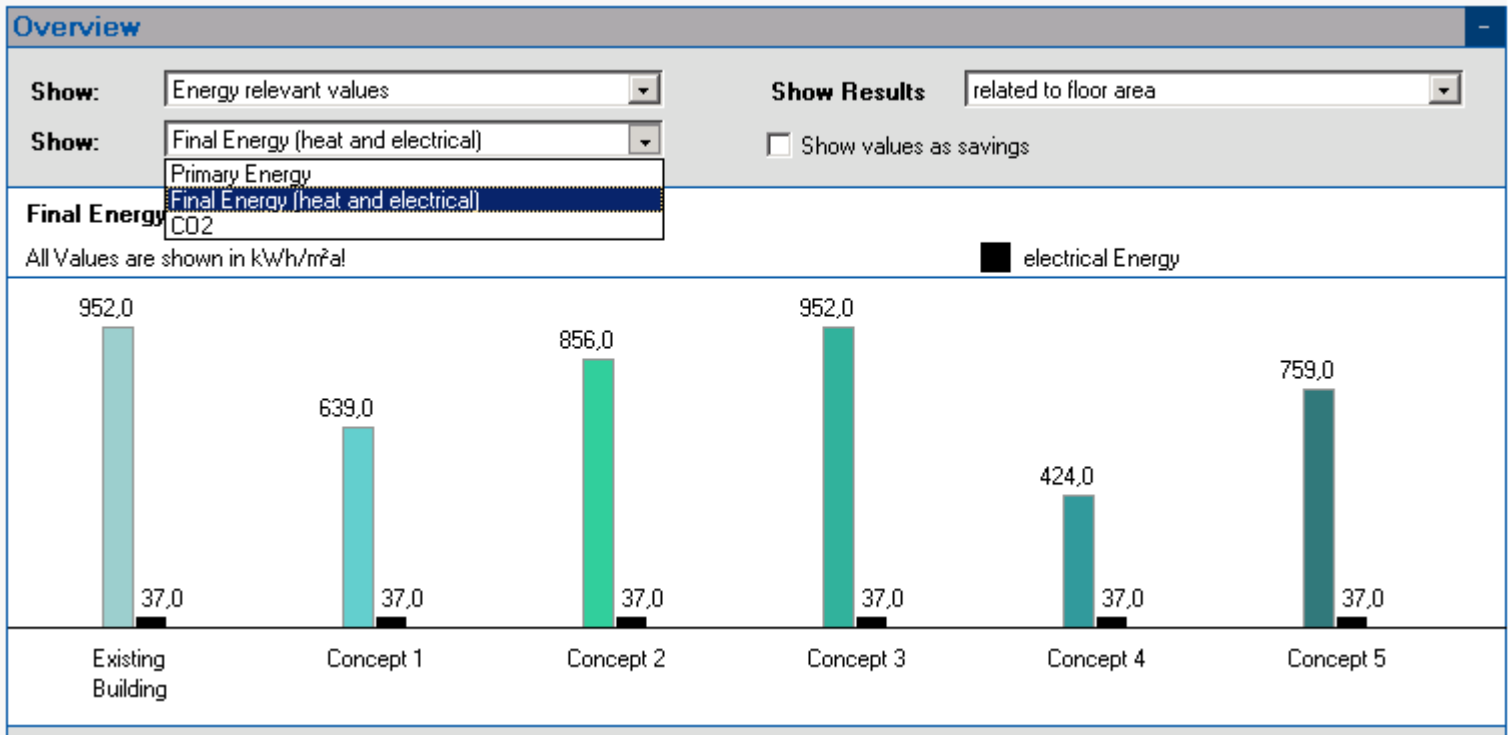
Show: Primary Energy — ☐ Show values as savings

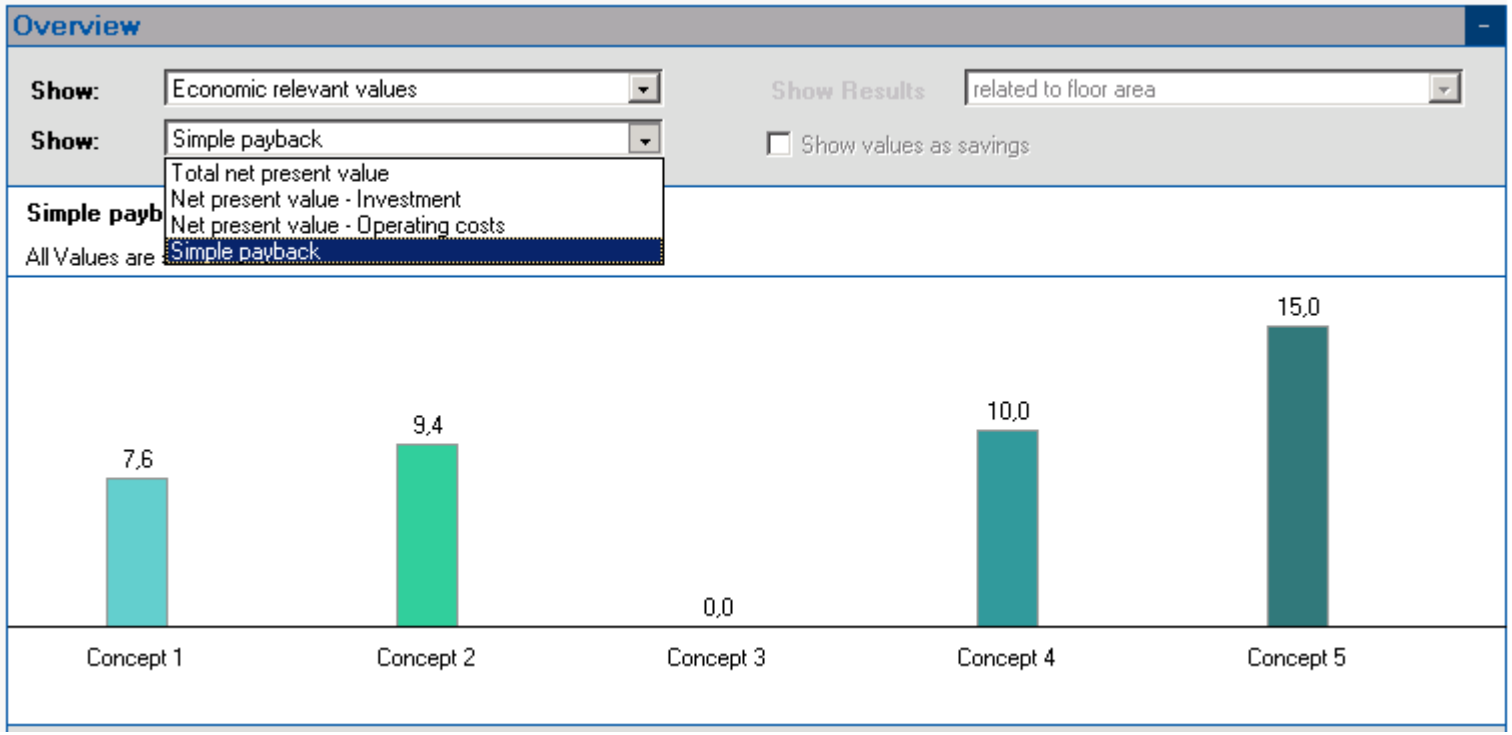
Primary Energy

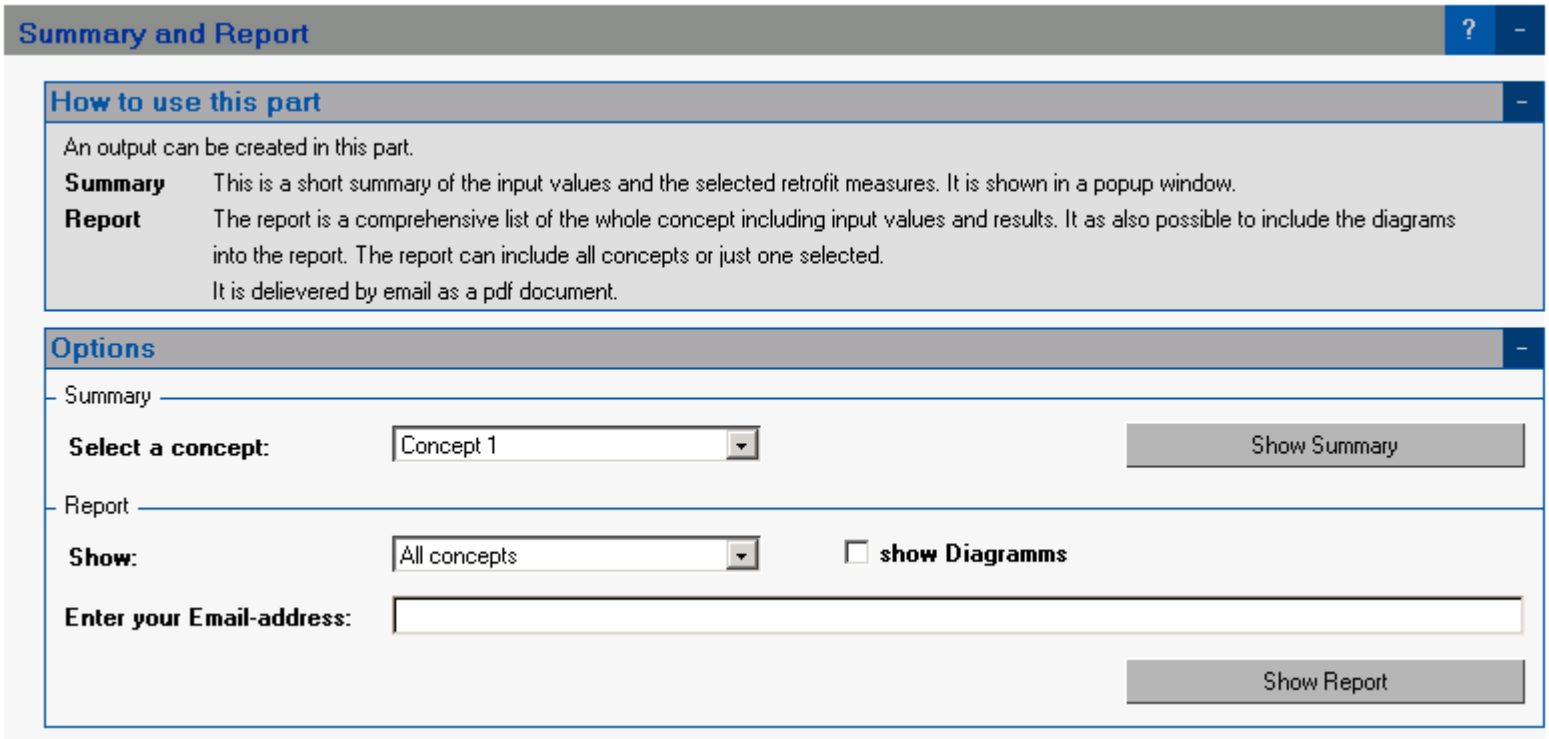
All Values are shown in kWh/m²a

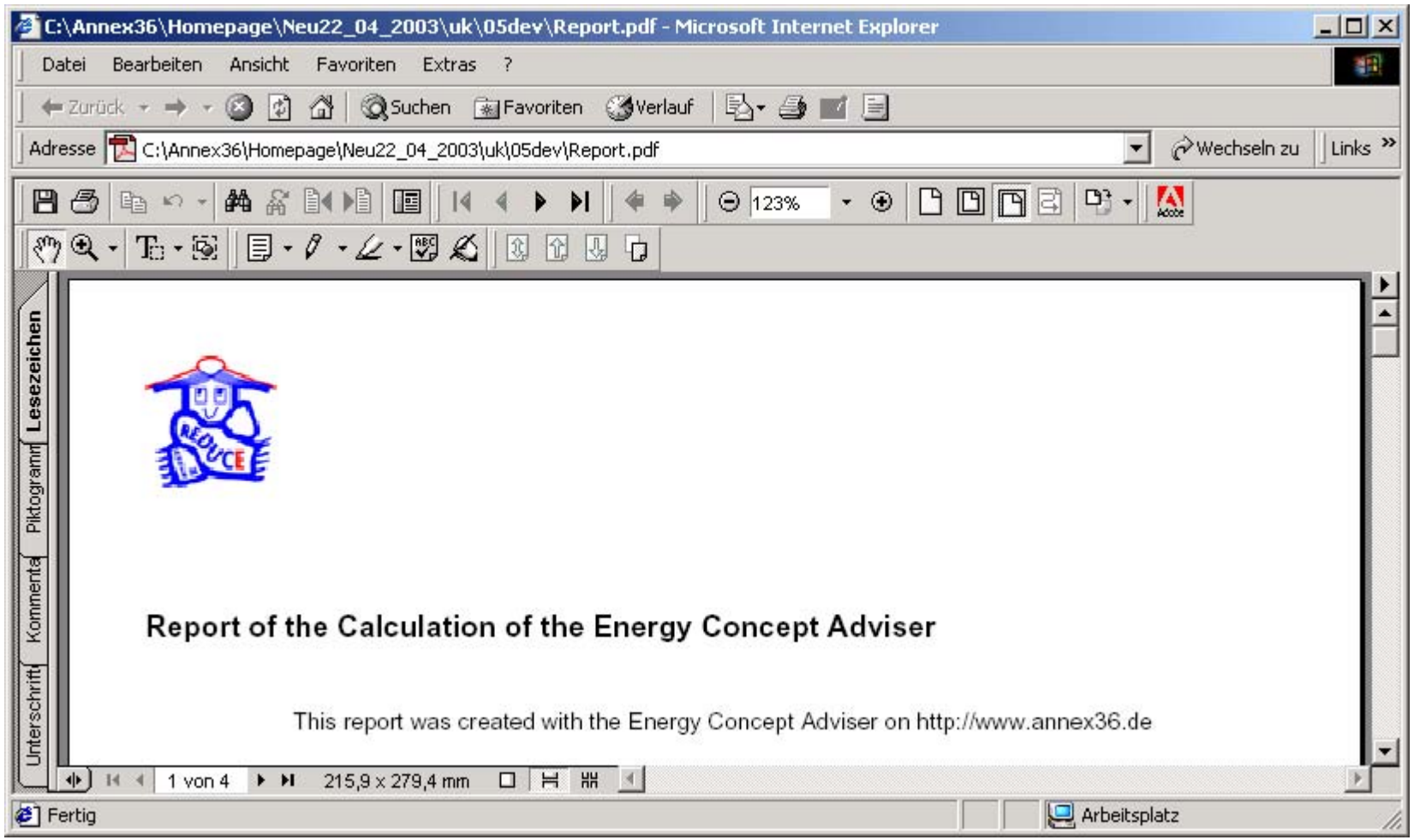



Overview
Show:
Energy relevant values
Show:
Primary Energy
Show Results
as absolute values
as absolute values
related to heated volume
related to floor area
Show values as
Primary Energy
All Values are shown in kWh/a!
2120000
652000
0
3580000
1300000
Concept 1
Concept 2
Concept 3
Concept 4
Concept 5


Overview
Show:
Energy relevant values
Show Results
related to floor area
Show:
Final Energy (heat and electrical)
Show values as savings
Primary Energy
Final Energy (heat and electrical)
CO2
Final Energy
All Values are shown in kWh/m²a!
electrical Energy
952,0
37,0
639,0
37,0
856,0
37,0
952,0
37,0
424,0
37,0
759,0
37,0
Existing Building
Concept 1
Concept 2
Concept 3
Concept 4
Concept 5


Overview
Show:
Economic relevant values
Show Results
related to floor area
Show:
Simple payback
Show values as savings
Total net present value
Net present value - Investment
Net present value - Operating costs
Simple payback
Simple payb
All Values are
7,6
9,4
0,0
10,0
15,0
Concept 1
Concept 2
Concept 3
Concept 4
Concept 5


Summary and Report
?
How to use this part
An output can be created in this part.
Summary
This is a short summary of the input values and the selected retrofit measures. It is shown in a popup window.
Report
The report is a comprehensive list of the whole concept including input values and results. It as also possible to include the diagrams into the report. The report can include all concepts or just one selected.
It is delievered by email as a pdf document.
Options
Summary
Select a concept:
Concept 1
Show Summary
Report
Show:
All concepts
show Diagramms
Enter your Email-address:
Show Report


C:\Annex36\Homepage\Neu22_04_2003\uk\05dev\Report.pdf - Microsoft Internet Explorer
Datei Bearbeiten Ansicht Favoriten Extras ?
Zurück Suchen Favoriten Verlauf
Adresse C:\Annex36\Homepage\Neu22_04_2003\uk\05dev\Report.pdf
Wechseln zu Links
123%
Lesezeichen
Piktogramm
Kommenta
Unterschrift
Report of the Calculation of the Energy Concept Adviser
This report was created with the Energy Concept Adviser on http://www.annex36.de
1 von 4
215,9 x 279,4 mm
Fertig
Arbeitsplatz

Home

Utilities

KULU IEA ECBCS Annex 36

VTT

Home

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